L9 ANSWER 1 OF 7 CA
AN 138:5819 CA
TI Selective alkylation of **catechol** with tert-**butyl** **alcohol** over HY and modified HY **zeolites**
AU Anand, R.; Maheswari, R.; Gore, K. U.; Chumbhale, V. R.
CS Catalysis Division, National Chemical Laboratory, Pune, 411 008, India
SO Catalysis Communications (2002), 3(8), 321-326
CODEN: CCAOAC; ISSN: 1566-7367
PB Elsevier Science B.V.
DT Journal
LA English
CC 45-4 (Industrial Organic Chemicals, Leather, Fats, and Waxes)
Section cross-reference(s): 67
AB Vapor phase alkylation of catechol with t-BuOH was studied over HY and dealuminated HY zeolites at 120-200.degree.C. The predominant product is 4-tert-butylcatechol (4-TBC) with >86% selectivity; the minor products are 3-tert-butylcatechol and 3,5-di-tert-butylcatechol. Dealuminated HY zeolites (steamed at 550.degree. and 700.degree.) showed marked increase in catechol conversion and 4-TBC yield. The effects of various reaction parameters, such as temp., space velocity and reactant molar ratio are discussed.
ST catechol butylation zeolite catalyst; butylcatechol prepn catechol butylation catalyst
IT Dealuminated Y zeolites
RL: CAT (Catalyst use); USES (Uses)
(HY; selective alkylation of catechol with t-BuOH over dealuminated HY zeolites)
IT Zeolite HY
RL: CAT (Catalyst use); USES (Uses)
(dealuminated; selective alkylation of catechol with t-BuOH over dealuminated HY zeolites)
IT Butylation catalysts
(selective alkylation of catechol with t-BuOH over dealuminated HY zeolites)
IT 98-29-3P, 4-tert-Butylcatechol
RL: IMF (Industrial manufacture); PREP (Preparation)
(prepn. by selective alkylation of catechol with t-BuOH over dealuminated HY zeolites)

IT 75-65-0, tert-**Butanol**, reactions 120-80-9, Catechol, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(selective alkylation of **catechol** with t-BuOH over
dealuminated HY **zeolites**)
RE.CNT 12 THERE ARE 12 CITED REFERENCES AVAILABLE FOR THIS RECORD
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L9 ANSWER 2 OF 7 CA
AN 136:355704 CA
TI Alkylation of **catechol** with tert-**butyl alcohol**
over H.beta. **zeolite**

AU Zhang, Jingchang; Sun, Faqun; Cao, Weiliang; Zhang, Tianqiao
CS Faculty of Science, Beijing University of Chemical Technology, Beijing,
100029, Peop. Rep. China

SO Cuihua Xuebao (2002), 23(1), 33-36
CODEN: THHPD3; ISSN: 0253-9837
PB Kexue Chubanshe
DT Journal
LA Chinese
CC 37-2 (Plastics Manufacture and Processing)

AB Catalytic performance of H.beta. and modified H.beta./Al2O3 in alkylation
of catechol with tert-Bu alc. was investigated. The structure and acid
properties of the catalysts were characterized by XRD and NH3-TPD
techniques. The influence of acidity of the zeolite on catalytic activity
and selectivity was discussed. The results showed that the selectivity of
Co-.beta./Al2O3 for 4-tert-butylcatechol reaches 99%, and the catechol
conversion is 71%, which is the best result reported in refs. up to date.
H.beta. zeolite and Co-modified H.beta./Al2O3 are prospective catalysts
for alkylation of catechol with t-Bu alc.

ST catechol butyl alc alkylation zeolite catalyst
IT Alkylation catalysts

(alkylation of catechol with tert-Bu alc. over H.beta.
zeolite)
IT H-Beta zeolites
RL: CAT (Catalyst use); SPN (Synthetic preparation); PREP
(Preparation);
USES (Uses)
(alkylation of catechol with tert-Bu alc. over H.beta.
zeolite)
IT Beta zeolites
RL: RCT (Reactant); RACT (Reactant or reagent)
(alkylation of catechol with tert-Bu alc. over H.beta.
zeolite)
IT 1344-28-1, Alumina, uses
RL: CAT (Catalyst use); USES (Uses)
(alkylation of catechol with tert-Bu alc. over H.beta.
zeolite)
IT 75-65-0, tert-**Butanol**, reactions 120-80-9, O-Dihydroxybenzene,
reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(alkylation of **catechol** with tert-Bu alc. over H.beta.
zeolite)
IT 98-29-3P, 4-Tert-Butyl-1,2-benzenediol
RL: SPN (Synthetic preparation); PREP (Preparation)
(alkylation of catechol with tert-Bu alc. over H.beta.
zeolite)

L9 ANSWER 3 OF 7 CA
AN 136:249325 CA
TI Alkylation of **catechol** with tert-**butyl alcohol**
over modified Co.beta. **zeolite**
AU Zhang, Jing-chang; Sun, Fa-qun; Cao, Wei-liang
CS Faculty of Science, Beijing University of Chemical Technology,
Beijing,
100029, Peop. Rep. China
SO Ningxia Daxue Xuebao, Ziran Kexueban (2001), 22(2), 109-111
CODEN: NDXKD8; ISSN: 0253-2328
PB Ningxia Daxue Xuebao, Ziran Kexueban Bianjibu
DT Journal
LA Chinese
CC 45-4 (Industrial Organic Chemicals, Leather, Fats, and Waxes)
Section cross-reference(s): 67
AB Alkylation of catechol with t-BuOH over modified .beta. zeolites
was
investigated. The pore structure and acid properties of
catalysts were
characterized by XRD and NH3-TPD. The activity of Co.beta.
zeolite is
high, the conversion of catechol is 71% and the selectivity to
4-tert-butylcatechol is 99%.
ST **catechol** alkylation **butanol** cobalt **zeolite**
catalyst; butylcatechol prepn **catechol** alkylation catalyst

IT Beta zeolites
RL: CAT (Catalyst use); USES (Uses)
(cobalt-modified; prepn. by catechol alkylation with t-BuOH over
Co-beta zeolite catalysts)
IT Alkylation catalysts
(prepn. by catechol alkylation with t-BuOH over Co-beta zeolite
catalysts)
IT 75-65-0, tert-**Butanol**, reactions 120-80-9, Catechol, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(**catechol** alkylation with t-BuOH over Co-beta **zeolite**
catalysts)
IT 98-29-3P, 4-tert-Butylcatechol
RL: IMF (Industrial manufacture); PREP (Preparation)
(prepn. by catechol alkylation with t-BuOH over Co-beta zeolite
catalysts)

L9 ANSWER 4 OF 7 CA COPYRIGHT 2003 ACS
AN 135:152408 CA
TI Alkylation of dihydroxybenzenes and anisole with methyl-tert-butyl ether
(MTBE) over solid acid catalysts
AU Yadav, G. D.; Goel, P. K.; Joshi, A. V.
CS Chemical Engineering Division, University Department of Chemical
Technology (UDCT), Matunga, Mumbai, 400 019, India
SO Green Chemistry (2001), 3(2), 92-99
CODEN: GRCHFJ; ISSN: 1463-9262
PB Royal Society of Chemistry
DT Journal
LA English
CC 22-4 (Physical Organic Chemistry)
AB The synthesis of tert-butylated dihydroxy and alkoxy benzenes from
catechol, **resorcinol** and anisole, with MTBE has been
carried out in presence of variety of solid acid catalysts. The current
work dealt with the efficacy of various solid acid catalysts in the
alkylation of substituted benzenes and MTBE. MTBE is a better
tert-butylating agent than **isobutylene** and tert-Bu alc. 20%
wt./wt. dodecatungstophosphoric acid (DTP) supported on K10
montmorillonite clay was found to be very effective in comparison
with other solid acid catalysts used. A complete theor. and exptl. anal.
is presented for the model studies of **catechol**/anisole with
MTBE. The reaction follows a typical second order kinetics at a fixed
catalyst loading, with weak adsorption of both the species. The energy of

activation for **catechol** alkylation was found to be 8.86 kcal
mol-1, which was low and suggested that intraparticle diffusional
resistance would set in for larger particle size. For anisole alkylation
the energy of activation was 17.36 kcal mol-1 indicating that the reaction
is intrinsically kinetically controlled.

ST dihydroxybenzene anisole alkylation kinetics MTBE solid acid catalysts

IT Reaction kinetics
(Friedel-Crafts reaction kinetics; alkylation of dihydroxybenzenes and
anisole with MTBE over solid acid catalysts)

IT Activation energy
Friedel-Crafts reaction
Friedel-Crafts reaction catalysts
Particle size
Surface reaction
Tert-butylation
(alkylation of dihydroxybenzenes and anisole with MTBE over solid acid
catalysts)

IT Phenols, reactions
RL: PEP (Physical, engineering or chemical process); PRP (Properties); RCT
(Reactant); PROC (Process); RACT (Reactant or reagent)
(alkylation of dihydroxybenzenes and anisole with MTBE over solid acid
catalysts)

IT Friedel-Crafts reaction
(kinetics; alkylation of dihydroxybenzenes and anisole with MTBE over
solid acid catalysts)

IT 1318-93-0, montmorillonite K10, uses
RL: CAT (Catalyst use); USES (Uses)
(alkylation of dihydroxybenzenes and anisole with MTBE over solid acid
catalysts)

IT 100-66-3, Anisole, reactions 108-46-3, Resorcinol, reactions 120-80-9,
Catechol, reactions
RL: PEP (Physical, engineering or chemical process); PRP (Properties); RCT
(Reactant); PROC (Process); RACT (Reactant or reagent)
(alkylation of dihydroxybenzenes and anisole with MTBE over solid acid
catalysts)

IT 1634-04-4, MTBE
RL: RCT (Reactant); RACT (Reactant or reagent)
(alkylation of dihydroxybenzenes and anisole with MTBE over solid acid

catalysts)
IT 1343-93-7
RL: CAT (Catalyst use); USES (Uses)
(supported on K10 montmorillonite clay; alkylation of dihydroxybenzenes
and anisole with MTBE over solid acid catalysts)
RE.CNT 27 THERE ARE 27 CITED REFERENCES AVAILABLE FOR THIS RECORD
RE
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L9 ANSWER 5 OF 7 CA
AN 133:237465 CA
TI Alkylation of hydroquinone with methyl-tert-butyl-ether and tert-butanol
AU Yadav, G. D.; Doshi, N. S.
CS University Department of Chemical Technology (UDCT), Chemical Engineering
Division, University of Mumbai, Matunga, Mumbai, 400 019, India
SO Catalysis Today (2000), 60(3-4), 263-273
CODEN: CATTEA; ISSN: 0920-5861
PB Elsevier Science B.V.

ordered

DT Journal
LA English
CC 22-4 (Physical Organic Chemistry)
Section cross-reference(s): 45, 67

AB The alkylation of **hydroquinone** yields industrially important compds., amongst which tert-butylhydroquinone is a very important precursor for its use in pharmaceuticals and in developing photog. plates.
Twenty per cent (wt./wt.) dodecatungstophosphoric acid supported on K10 **montmorillonite** clay (DTP/K10) was found to be a very efficient and novel catalyst in comparison with several others for alkylation of **hydroquinone** with different alkylating agents such as methyl-tert-butyl-ether (MTBE) and tert-**butanol** at 150.degree.C in an autoclave. A summary of characterization of DTP/K10 is provided and related to the activity. Various reaction parameters were also investigated and a kinetic model was built. The rate of alkylation with MTBE was much faster than that with tert-**butanol**. The reaction follows a typical second order kinetics at a fixed catalyst loading with weak adsorption of both the species. The energy of activation was found to be 19.34 kcal/mol.

ST alkylation **hydroquinone** MTBE **butanol** heteropoly acid **montmorillonite** clay

IT Catalyst supports
(K10 **montmorillonite** clay; kinetics and mechanism of alkylation of **hydroquinone** with methyl-tert-Bu ether and tert-**butanol** over solid acid catalysts)

IT Activation energy
Adsorption
Alkylation
Alkylation catalysts
Alkylation kinetics
Surface reaction
(kinetics and mechanism of alkylation of hydroquinone with methyl-tert-Bu ether and tert-butanol over solid acid catalysts)

IT Heteropoly acids
RL: CAT (Catalyst use); USES (Uses)
(kinetics and mechanism of alkylation of hydroquinone with methyl-tert-Bu ether and tert-butanol over solid acid catalysts)

IT Clays, uses
RL: CAT (Catalyst use); USES (Uses)
(montmorillonitic, K10; kinetics and mechanism of alkylation of hydroquinone with methyl-tert-Bu ether and tert-butanol over solid acid

catalysts)
IT Acids, uses
RL: CAT (Catalyst use); USES (Uses)
(solid; kinetics and mechanism of alkylation of hydroquinone with
methyl-tert-Bu ether and tert-butanol over solid acid catalysts)
IT 7646-85-7, Zinc dichloride, uses
RL: CAT (Catalyst use); USES (Uses)
(clayzic (20% ZnCl2/K-10 **montmorillonite**); kinetics and mechanism of alkylation of **hydroquinone** with methyl-tert-Bu ether and tert-**butanol** over solid acid catalysts)
IT 1314-23-4D, Zirconia, sulfated 1343-93-7 12027-38-2
RL: CAT (Catalyst use); USES (Uses)
(kinetics and mechanism of alkylation of hydroquinone with methyl-tert-Bu ether and tert-butanol over solid acid catalysts)
IT 88-58-4P, 2,5-Di-tert-butyl-1,4-hydroquinone 1948-33-0P, 2-tert-Butyl-1,4-hydroquinone
RL: IMF (Industrial manufacture); SPN (Synthetic preparation); PREP (Preparation)
(kinetics and mechanism of alkylation of hydroquinone with methyl-tert-Bu ether and tert-butanol over solid acid catalysts)
IT 123-31-9, p-Hydroquinone, reactions 1634-04-4, MTBE
RL: PEP (Physical, engineering or chemical process); PRP (Properties); RCT (Reactant); PROC (Process); RACT (Reactant or reagent)
(kinetics and mechanism of alkylation of hydroquinone with methyl-tert-Bu ether and tert-butanol over solid acid catalysts)
IT 75-65-0, tert-Butanol, reactions
RL: PEP (Physical, engineering or chemical process); RCT (Reactant); PROC (Process); RACT (Reactant or reagent)
(kinetics and mechanism of alkylation of hydroquinone with methyl-tert-Bu ether and tert-butanol over solid acid catalysts)
RE.CNT 21 THERE ARE 21 CITED REFERENCES AVAILABLE FOR THIS RECORD
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1999, P254 CA
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AN 132:207509 CA
TI Alkylation of **catechol** with t-**butyl alcohol** over acidic **zeolites**
AU Yoo, J. W.; Lee, C. W.; Park, S.-E.; Ko, J.
CS Yusung, P.O. Box 107, Industrial Catalysis Research Lab., Korea Research Institute of Chemical Technology (KRICT), Taejon, S. Korea
SO Applied Catalysis, A: General (1999), 187(2), 225-232
CODEN: ACAGE4; ISSN: 0926-860X
PB Elsevier Science B.V.
DT Journal
LA English

CC 22-4 (Physical Organic Chemistry)
Section cross-reference(s): 67
OS CASREACT 132:207509
AB The catalytic properties of H-ZSM-5 in catechol alkylation with Me3COH are compared to that of other solid acid catalysts, H-USY, H-beta, .gamma.-alumina. H-ZSM-5 zeolite shows a selectivity >84% and conversion >90% for 4-tert-butylcatechol (4-TBC), while 3,5-di-tert-butylcatechol (DTBC) and 3-tert-butylcatechol (3-TBC) are produced as minor byproducts, which are identified by GC/MS and 1H-NMR. When the Na cation-exchange level, Na/H, of NaH-ZSM-5 increases, the conversion and DTBC selectivity decrease rapidly and 3-tert-butylcatechol (3-TBC) selectivity grows. As the SiO2/Al2O3 ratio of H-ZSM-5 increases, the conversion and DTBC selectivity decrease. Selectivities for 4-TBC over NaH-ZSM-5 with 3 different Na cation-exchange levels and over ZSM-5 with 3 different

SiO2/Al2O3 ratios are not changed significantly. Surface modification of
H-ZSM-5 via CVD with tetraethylorthosilicate (TEOS) or poisoning with
tributylamine (TBA) leads to the redn. of DTBC selectivity, and
simultaneously, to the improvement of 4-TBC selectivity. Variations of
catalytic activity over ZSM-5 catalysts are compared and discussed in
terms of the concn. and strength of the acid site detd. by FTIR
spectroscopy. Strong Broensted acid sites seem to be responsible for the
t-butylation of catechol.

ST tertbutyl alc alkylation **catechol** acidic **zeolite**
catalyst; **tertbutanol** tertbutylation **catechol** acidic
zeolite

IT Surface acidity
Surface acidity
(Bronsted; alkylation of catechol with t-Bu alc. over acidic zeolites)

IT IR spectroscopy
(Fourier-transform; alkylation of catechol with t-Bu alc. over acidic
zeolites)

IT Ultrastable Y zeolites
RL: CAT (Catalyst use); PEP (Physical, engineering or chemical process);
PRP (Properties); PROC (Process); USES (Uses)
(HY; alkylation of catechol with t-Bu alc. over acidic zeolites)

IT Surface acidity
Surface acidity
(Lewis; alkylation of catechol with t-Bu alc. over acidic zeolites)

IT Zeolite NaY
RL: CAT (Catalyst use); PEP (Physical, engineering or chemical process);
PRP (Properties); PROC (Process); USES (Uses)
(NaHZSM-5; alkylation of catechol with t-Bu alc. over acidic zeolites)

IT Catalysis
(acid; alkylation of catechol with t-Bu alc. over acidic zeolites)

IT Zeolites (synthetic), properties
RL: CAT (Catalyst use); PEP (Physical, engineering or chemical process);
PRP (Properties); PROC (Process); USES (Uses)
(acidic; alkylation of catechol with t-Bu alc. over acidic zeolites)

IT Alkylation
Chemisorbed substances

Chemisorption
IR spectra
Poisoning, catalytic
Surface reaction
Tert-butylation
(alkylation of catechol with t-Bu alc. over acidic zeolites)
IT H-Beta zeolites
Zeolite ZSM-5
RL: CAT (Catalyst use); PEP (Physical, engineering or chemical process);
PRP (Properties); PROC (Process); USES (Uses)
(alkylation of catechol with t-Bu alc. over acidic zeolites)
IT Alcohols, reactions
RL: PEP (Physical, engineering or chemical process); RCT (Reactant); PROC
(Process); RACT (Reactant or reagent)
(alkylation of catechol with t-Bu alc. over acidic zeolites)
IT Cation exchange
(catalyst effect of Na; alkylation of catechol with t-Bu alc. over
acidic zeolites)
IT Tert-butylation
Tert-butylation
(catalysts; alkylation of catechol with t-Bu alc. over acidic zeolites)
IT Vapor deposition process
(chem., catalytic effect of TEOS; alkylation of catechol with t-Bu alc.
over acidic zeolites)
IT Bronsted acidity
Bronsted acidity
Lewis acidity
Lewis acidity
Reaction mechanism
(surface; alkylation of catechol with t-Bu alc. over acidic zeolites)
IT Alkylation catalysts
Alkylation catalysts
(tert-butylation; alkylation of catechol with t-Bu alc. over acidic
zeolites)
IT Zeolite HY
RL: CAT (Catalyst use); PEP (Physical, engineering or chemical process);
PRP (Properties); PROC (Process); USES (Uses)
(ultrastable; alkylation of catechol with t-Bu alc. over acidic
zeolites)
IT 78-10-4, Tetraethylorthosilicate
RL: CAT (Catalyst use); PEP (Physical, engineering or chemical process);

PROC (Process); USES (Uses)
(CVD of zeolite catalyst; alkylation of catechol with t-Bu alc. over
acidic zeolites)
IT 1020-31-1P, 3,5-Di-tert-butylcatechol 4026-05-5P, 3-tert-Butylcatechol
RL: BYP (Byproduct); PREP (Preparation)
(alkylation of catechol with t-Bu alc. over acidic zeolites)
IT 75-65-0, tert-**Butyl alcohol**, reactions 120-80-9,
1,2-Benzenediol, reactions
RL: PEP (Physical, engineering or chemical process); RCT (Reactant); PROC
(Process); RACT (Reactant or reagent)
(alkylation of **catechol** with t-Bu alc. over acidic
zeolites)
IT 98-29-3P, 4-tert-Butylcatechol
RL: SPN (Synthetic preparation); PREP (Preparation)
(alkylation of catechol with t-Bu alc. over acidic zeolites)
IT 102-82-9, Tributylamine
RL: CAT (Catalyst use); PEP (Physical, engineering or chemical process);
PROC (Process); USES (Uses)
(catalyst poison; alkylation of catechol with t-Bu alc. over acidic
zeolites)
IT 7440-23-5, Sodium, uses
RL: CAT (Catalyst use); PEP (Physical, engineering or chemical process);
PROC (Process); USES (Uses)
(catalytic effect of zeolite cation exchange; alkylation of catechol
with t-Bu alc. over acidic zeolites)
IT 110-86-1, Pyridine, properties
RL: CAT (Catalyst use); PEP (Physical, engineering or chemical process);
PRP (Properties); PROC (Process); USES (Uses)
(chemisorption; alkylation of catechol with t-Bu alc. over acidic
zeolites)
IT 1344-28-1, Alumina, properties
RL: CAT (Catalyst use); PEP (Physical, engineering or chemical process);
PRP (Properties); PROC (Process); USES (Uses)
(.gamma.-; alkylation of catechol with t-Bu alc. over acidic zeolites)
RE.CNT 28 THERE ARE 28 CITED REFERENCES AVAILABLE FOR THIS RECORD
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